

# The Meteorological Magazine



Vol. 72

April,  
1937

No. 855

Air Ministry: Meteorological Office

LONDON: PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE

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## Light Winds in the London Area

The *Monthly Weather Report* contains each month a table (Table II), giving, among other data, the number of hours with winds having velocities between certain limits at each of the stations where an anemometer is installed. Similar information for the whole year is given in the *Annual Summary of the Monthly Weather Report*. The table includes data from three stations in the London area, namely, South Kensington, Kew Observatory and Croydon Aerodrome. Attention was first directed to the phenomenon which is the subject of this note by the results summarized in Table I, which refers to the year 1935. It will be seen that in 1935 there were only 13 hours at South Kensington with a wind speed exceeding 24 m.p.h. as compared with 95 hours at Kew and 371 hours at Croydon. In the category 13 to 24 m.p.h., which includes moderate and fresh winds, we again have the lowest frequency at South Kensington and the highest at Croydon. In the next category, light winds 4 to 12 m.p.h., the order is reversed, as might be expected. Finally, we come to "light airs and calms" (less than 4 m.p.h.) and here we find the really interesting feature of the table, namely the fact that these very light winds were very decidedly less frequent at South Kensington in 1935, than at either Kew or Croydon.

A brief examination of the data for earlier years showed that the results for 1935 were not exceptional, and it was therefore thought worth while to look into the matter a little more closely. Results

of wind speed, direction, and rain, is a day in which 0.2 in. or more rain has fallen.  
1018.1  
Victoria, B.C.  
1.7  
73  
43  
62.1  
47.7  
54.9  
1.2  
59.7  
84  
5.3  
1.39  
0.42  
8  
7.7  
61

from the South Kensington anemometer are available from the year 1930, and it was thus possible to determine the monthly average frequency of winds under 4 m.p.h. for the period of 7 years

TABLE I. FREQUENCY OF WINDS OF STATED VELOCITY IN 1935.  
(Total duration in hours, and percentages).

Station.		Above 38 m.p.h.	25 to 38 m.p.h.	13 to 24 m.p.h.	4 to 12 m.p.h.	Less than 4 m.p.h.
South Ken- sington.	hours ...	0	13	1723	6322	702
	percentage	0	0.15	20	72	8
Kew Observ- atory.	hours ...	0	95	2083	5025	1557
	percentage	0	1.1	24	57	18
Croydon ...	hours ...	0	371	2969	4177	1243
	percentage	0	4	34	48	14

1930 to 1936. The data for the other two stations were averaged over the same period and the results are given in Table II. Here the averages are given in the form of percentages of the total time.

A period of only seven years is of course far too short to give reliable monthly averages of the frequency of any element, and it will be seen that the variations from month to month of the values in Table II are very irregular. We may presume, however, that all

TABLE II. PERCENTAGE FREQUENCIES OF WINDS OF LESS THAN 4 M.P.H.  
(Averages for 7 years 1930-6).

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
South Kensington	% 13	% 9	% 13	% 10	% 11	% 12	% 10	% 15	% 15	% 9	% 13	% 15	% 12
Kew Observatory	21	16	20	15	20	19	19	27	23	19	23	22	21
Croydon ...	13	12	12	8	13	15	15	20	19	11	17	15	14

three stations were similarly affected by general factors causing fluctuations above or below normal and that the results give a fairly reliable indication of the relative frequencies of very light winds and calms at the three stations. We conclude therefore that, (a) winds of less than 4 m.p.h. are little more than half as frequent in central London as at Kew Observatory in all months; and (b) winds of less than 4 m.p.h. are decidedly less frequent in central London than at Croydon, from May to November; from December to April the frequencies in the two areas tend to be about the same.

The anemometers at South Kensington, Kew and Croydon are all of the modern Dines pattern, and in each case the instrument

is installed above the roof of a large building. The sites, however, differ considerably. At South Kensington the anemometer head is 30 ft. above the roof of the Science Museum, 110 ft. above ground and 137 ft. above sea level; the "effective height" is judged to be 30 ft., because the head is higher by that amount than the general roof level of the buildings in the vicinity. The flow of air is highly turbulent; the mean velocity in gusts is nearly double the mean wind velocity and in lulls the velocity often decreases to zero. At Kew, the anemometer head is 75 ft. above ground and 92 ft. above sea level; park land surrounds the Observatory for some distance, but on the western side there is a row of tall trees about 300 yards from the building. At Croydon the anemometer is mounted above the control tower of the airport; the head is 105 ft. above ground and 313 ft. above sea level.

Of the three instruments, Croydon has the best exposure; it is also the highest above sea level and has the greatest effective height above ground. The results for Croydon and Kew given in Table I are completely in harmony with expectations based on these considerations. In regard to South Kensington, the general tendency is for the mean wind speed to be reduced by the frictional resistance of the buildings which cover a large proportion of the ground in London. This accounts for the infrequency of winds exceeding 12 m.p.h. and for the large percentage of winds with velocities between 4 and 12 m.p.h. It appears, however, that very light winds and calms are subject to a different form of topographical control, otherwise we should find a very high frequency of these winds at South Kensington.

Several other stations recorded a low frequency of strong winds in 1935, but in all cases except South Kensington the proportion of winds of less than 4 m.p.h. was correspondingly high; thus at Balmakewan there were only 44 hours in which the mean velocity exceeded 24 m.p.h. but there were 3,221 hours under 4 m.p.h. In general high durations of very light winds were recorded inland and low durations on the coast, but there were some exceptions. Only two other inland stations recorded a lower duration than South Kensington, namely Cardington and Birmingham. In both these cases the anemometer is at an abnormal height above ground, and at Birmingham the instrument is also in a large city. At most coastal stations the duration of winds below 4 m.p.h. was similar to that observed at South Kensington.

It is well known that the lull of wind at night is related to the cooling of the ground by radiation and the establishment of a surface inversion of temperature. It is also well known that the temperature at night in the middle of London is higher than in the outer suburbs or in neighbouring rural situations. It seems probable, therefore, that there are frequent occasions when an inversion has become established at Kew and Croydon up to the height of the

anemometer head, while at South Kensington the lapse rate of temperature at the level of the anemometer remains normal. The night temperature of London tends to approximate to that of the sea coast rather than to that of an inland rural situation and it is of interest to find that London also resembles the coast in respect to the frequency of very light winds and calms. This fact is not merely one of academic interest; it must have an important bearing on such matters as the formation and distribution of town fog, and the dispersal of poison gas in the event of the use of such a method by an enemy in an aerial attack on London and other large cities.

E. G. BILHAM.

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### Work of the British Group of the International Commission of Snow

In the spring of 1936, Professor J. E. Church, of the United States, President of the newly formed International Commission of Snow which is under the International Association of Hydrology, itself a division of the International Union of Geodesy and Geophysics, requested Mr. G. Seligman to arrange British co-operation at the first meeting of the Commission to be held in Edinburgh in the following September. Mr. Seligman then took counsel with a few people likely to be interested in the matter, and all agreed that it would be unthinkable to allow such a gathering to take place in the capital of Scotland without British participation therein. Accordingly Mr. Seligman who was to act as Chairman of a British contingent, lost no time in approaching every meteorologist, geographer, hydrologist, glaciologist and geologist in Great Britain who could be remembered as having done any definite work in any aspect of its scientific study of snow. The result was that by the time the autumn came round British representation was quite as strong as that of many other countries whose units had been formed earlier, numbering 16, of whom 10 came to Edinburgh. From the British section four papers were communicated; one by Capt. W. N. McClean on the influence of snow and ice on river-discharge measurements in the Highlands of Scotland; one by Dr. F. Loewe on the maintenance of the Greenland ice-sheet; and two by Mr. L. C. W. Bonacina on (1) problems of drifting snow in the British Isles with special reference to the Scottish Highlands, and (2) factors controlling the distribution of snowfall over the globe. Thus two of the papers, as befitted the occasion, discussed snowfall in our own country. Every paper read, or submitted to the Conference, will eventually appear in the *Proceedings of the International Association of Scientific Hydrology*.

Up to date (March, 1937) the British group or section of the International Snow Commission consists of the following:—G. Seligman, H. R. Mill, F. C. Debenham, C. K. M. Douglas, A. R. Glen, A. E. H. Tutton, G. Manley, R. Moss, W. N. McClean, K. S.

Sandford, J. M. Wordie, T. G. Longstaff, L. Hawkes, W. R. Higginbottom, E. A. M. Wedderburn, H. MacRobert, A. H. R. Goldie, and L. C. W. Bonacina.

The President of the International Commission, Professor Church, had expressed a wish that in the interval between the Edinburgh gathering and the next at Washington in 1939, the different national units should pursue a domestic policy of their own, and so it was decided in Edinburgh on September 16th, 1936, to hold the first independent meeting of the British group in London on December 11th, 1936. This was held at 5 p.m. in a room kindly placed at the disposal of the group by the Royal Geographical Society. At this meeting domestic policy was discussed, followed by the reading of three papers, and a short account of the proceedings will now be given.

In relation to domestic policy Mr. Wordie was anxious to form a British Glacier group of the International Commission of Glaciers of the International Union of Geodesy and Geophysics, akin to the Snow group, and suggested that the two groups should hold joint meetings to which other persons interested in the study of snow and ice should also be invited. Thus it seemed to follow automatically that a new body should be formed consisting of members of the two commissions together with other interested persons. This view was unanimously supported, and on the proposal of Dr. Longstaff seconded by Mr. Bonacina it was decided to form such a body—to be known as the Snow and Ice Association. Before the decision was taken, however, Mr. Bonacina represented that it was first of all necessary to view snow and ice in proper perspective in relation to other natural phenomena, and showed that a special society for their investigation could actually be justified. A difficulty was to find a name for a science including all the varied forms of ice on the earth's surface. Glaciology would do, but is unfortunately by convention limited to the study of glaciers, and such terms of Greek derivation as "Cryology" or "Chionology" sound utterly barbarous. Hence it was resolved to fall back on plain Anglo-Saxon, and call the new body simply, as already stated, a "Snow and Ice Association".

The following papers were then read:—

- (1) "The firm structure of the North-East Land Ice Cap". By R. Moss.
- (2) "Survey of snowfall in the British Isles and problems needing investigation in the Scottish snow-beds". By L. C. W. Bonacina.\*
- (3) "Notes on the snowfall in northern England". By G. Manley.

The next meeting of the British group will take place on April 23rd, 1937, when further steps will be taken in the organization of the new Snow and Ice Association, a paper will be read by Mr. Odell on ice and snow erosion, and a discussion will be opened by

\* To be published in an early number of *Discovery*.

Mr. Bonacina on the meaning to be attached to the "fall" of snow in cases of long-distance mass drifting. Mr. G. Seligman will act as Chairman and Secretary for the time being, and is anxious to enrol as many members as possible among those to whom a study of snow and ice might be of interest, including geographers, geologists, physicists, mountaineers, ski-runners and others.

It will thus be seen that the British group of the International Snow Commission is, on the one hand, endeavouring to promote the study of the snowfall of these islands, and, on the other, to fit itself to give advice on snow problems to polar or high mountain expeditions about to leave these shores.

L. C. W. BONACINA.

### Iberian Peninsula swept by Severe Gales

Between January 26th and 28th, 1937, the Iberian peninsula was swept by very severe gales, much structural damage being done on land and at sea. At Leixoes (Oporto) at least sixteen trawlers and two steam lighters were sunk while at Setubal the British steamship *Terneuzen* was driven ashore.

Gibraltar experienced the full force of the gales, the wind there reaching momentarily in a gust at 15h. 10m. on the 27th, a velocity of 98 m.p.h. (See Fig. 1). The P. and O. liner, *Strathnaver*, after landing passengers at Gibraltar on the 27th, was compelled to seek shelter in Algeiras roadstead during the night, the passengers being marooned ashore until the following day, when they were re-embarked. The Union Castle Liner, *Llangibby Castle*, was unable to anchor in the harbour in the afternoon of the 27th, steamed out to sea and spent the night to the east of Gibraltar. The steamers *City of Durban* and *Langleetarn*, moored alongside the west side of North Mole Admiralty Harbour were unable to cast-off, and smashed the wall facing for about 60 feet, both steamers having several plates bent. An Italian steamship, the *Spartivento*, went ashore in the side of the bay quite near to the spot where in the previous April the P. and O. liner, *Ranpura*, carrying the Chinese art treasures, which had been on exhibition in London, went ashore. Shipping at Gibraltar was at a standstill, services to Tangier and Algeiras being suspended and also the patrol of the Straits by insurgent warships.

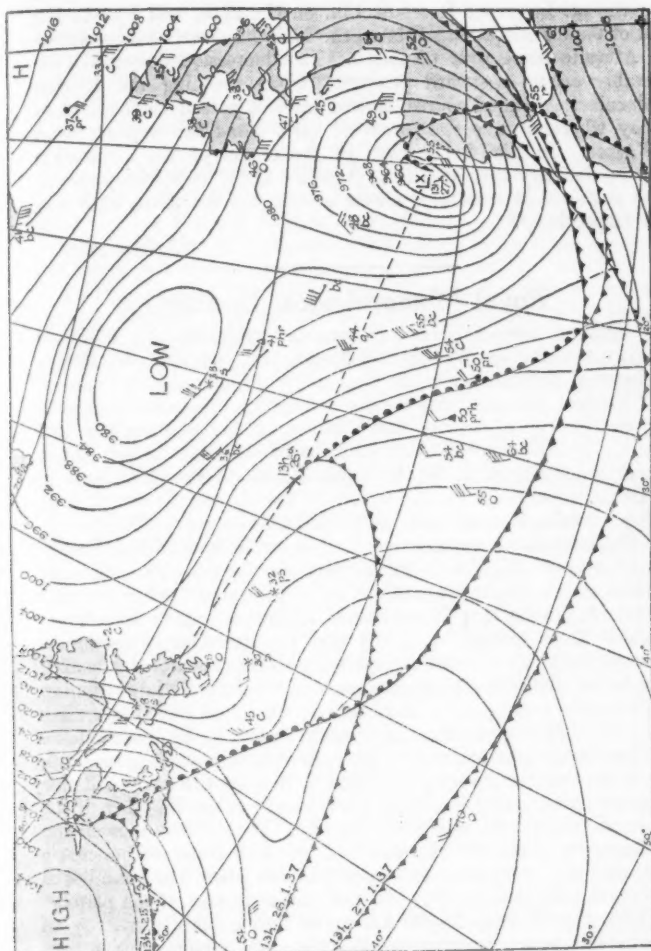
The fourth destroyer flotilla, which was on its way from England to Gibraltar, encountered the full strength of the gale and very rough seas. The *Beagle*, with its foremast and wireless carried away, reached Gibraltar escorted by the *Brazen* and two other destroyers. Only three destroyers were able to make the harbour on the evening of the 27th, the rest of the flotilla being compelled to spend the night at sea; the aircraft carrier *Courageous* was also unable to moor alongside the south mole or make harbour. The gale abated at Gibraltar on the morning of the 28th.

The gales extended as far south as Casablanca where they, together



[illegible]

ANEMOGRAM, GIBRALTAR, JANUARY 27th-28th, 1937



Warm front    Cold front    Occlusion  
 WEATHER CHART, NORTH ATLANTIC, 13h. JANUARY 27th, 1937

with the heavy seas, caused much damage to the harbour; many coastal roads were also rendered impassable.

The gales were associated with a depression which was centred near the St. Lawrence River at 13h. on the 25th, and just to the west of Cape Finisterre at 13h. on the 27th, its mean velocity across the Atlantic being over 60 m.p.h. The depression deepened considerably on its eastward passage. Upon reaching the Iberian Peninsula it changed course, slowed up and passed to the Bay of Biscay where it gave rise to severe gales along the western coast of France. In Fig. 2 the path of the centre of the depression between January 25th and 27th, is indicated together with approximate positions of associated fronts at 13h. on the 25th, 26th and 27th respectively.

J. CRICHTON.

### Royal Meteorological Society

The Symons Memorial Lecture was delivered at the Society's monthly meeting on Wednesday, March 17th, by Prof. D. Brunt, Professor of Meteorology in the University of London, on the subject of "Natural and artificial clouds". By kind permission of the Imperial College of Science and Technology, the meeting was held in the Royal College of Science, Imperial Institute Road, South Kensington. Dr. F. J. W. Whipple, F.Inst.P., President, was in the Chair.

The following is an abstract of the lecture :—

"The motions which occur when an unstable layer of fluid breaks down have been found to be in the form of polygonal prismatic cells, in which the motion at the centre of the cell is upward, when the fluid is a liquid. In air, it is shown that while the motions in deep layers resemble those in liquids, except that the direction of motion is reversed, the motion in shallow layers of air made unstable by heating from below is different in appearance, and consists of a large number of ascending currents, surrounded by much slower descending currents. The motion of the air is made visible by cigarette smoke.

When the air is bounded at its upper limit by a movable glass plate, it is found that the shearing produced by moving this plate will give long rolls extending through the whole length of the chamber, if the upper plate is moved sufficiently rapidly. With slower movements of the upper plate, the chamber is filled with distorted prismatic cells, and with very slow movements of the plate, the chamber is filled with rolls transverse to the direction of motion of the plate.

These experimental results are applied to explain a variety of cloud forms, which are thus presumably to be explained as in part due to the effects of instability. Among these clouds are those which consist of small cloudlets on a background of blue sky, cloud sheets which show a series of clear holes, and clouds in rolls, which may be analogous to either the longitudinal rolls found in the laboratory

with rapid shearing of the top plate, or to the transverse rolls found with slow shearing of the upper plate. Some comparison is given of the evidence of ascending currents in the atmosphere found by gliding pilots. A film shows the forms taken by unstable layers during the process of breakdown, as well as of some clouds which closely resemble the structures obtained in the laboratory."

### Correspondence

To the Editor, *Meteorological Magazine*

#### Cover Designs of the Meteorological Magazine

On reading the note in your February number on the new design for the cover it strikes me that some of your readers may care to be reminded that in Mr. Symons's time and up to 1903 the cover bore no design but merely the title in capital letters.

Mr Symons died in 1900 and when I came into sole control of the British Rainfall Organization in 1903 I asked Mr. M. J. Dawson, F.R.I.B.A., to design the cover depicting the Ben Nevis Observatory, which first appeared in Vol. 39 (1904) and was superseded in 1920.

HUGH ROBERT MILL.

*Hill Crest, Dormans Park, East Grinstead, Sussex, March 2nd, 1937.*

#### Abnormal Rainfall at Bognor Regis

Mr. D. S. Hancock, of Greenways School, Bognor Regis, Sussex, has expressed the abnormal rainfall at his meteorological station during 1937 in an unusual and interesting way. The following table shows the dates on which the accumulated totals amounted to 9 in. and 12 in. respectively in each year since 1929.

##### Total Rainfall.

		9 inches.	12 inches.
1929	...	July 5	August 12
1930	...	April 23	July 15
1931	...	May 21	July 14
1932	...	May 21	July 13
1933	...	May 6	June 20
1934	...	June 28	August 23
1935	...	April 25	June 11
1936	...	April 1	June 14
1937	...	February 24	March 12

The total of 9 in. was reached 37 days earlier than in any previous year, and the total of 12 in. no fewer than 91 days earlier.

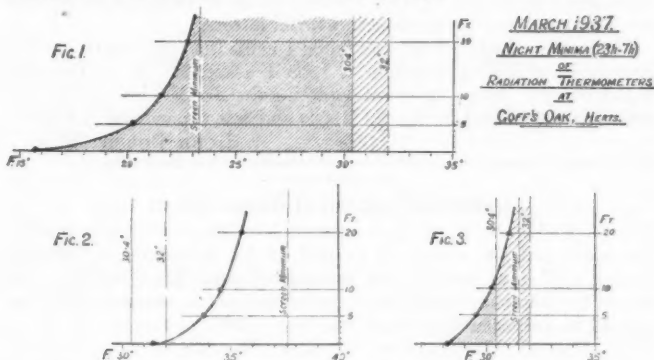
#### Night Radiation during the Cold Spell of March, 1937

The cold weather which set in over this country on February 28th, and persisted in varying degrees of severity until the middle of March, produced some remarkably low night minima from screen and radiation thermometers, and some of the values obtained at Goff's Oak, Herts, may be of interest.

The mean minimum temperature of the air (screen) for the period February 28th to March 12th, was  $31.5^{\circ}\text{F.}$ , and on many nights the terrestrial radiation was considerable, the minimum on the grass falling below  $32^{\circ}\text{F.}$  on every night during this period.

The night of March 9th to 10th produced a particularly severe frost, the screen minimum being as low as  $23.3^{\circ}\text{F.}$ , and being a clear, calm night, there was a pronounced inversion near the surface of the ground, the grass minimum being  $15.7^{\circ}\text{F.}$  This was the sharpest ground frost recorded in this district in the month of March since the year 1933.

The mean wind velocity as estimated by a three-cup anemometer at 23 ft. above the ground, was only 1.3 m.p.h., and the resultant effect of radiation is shown in the curve, Fig. 1.



Radiation was particularly active on the night of March 11th to 12th, and as may be seen in Fig. 2, the minima at 5 ft., 10 ft. and 20 ft., were  $3.8^{\circ}\text{F.}$ ,  $3.1^{\circ}\text{F.}$  and  $2.1^{\circ}\text{F.}$ , respectively, below the minimum in the screen. These figures show the greatest deviation of minima on any night of the 250 nights in the past two years for which radiation data are available at these levels. The mean wind velocity on this occasion was 6.4 m.p.h., so that although the sky was free of cloud, the inversion near the ground was not so pronounced as in the former case; but the values obtained give further indication of the high radiation activity associated with maritime cyclonic air,\* the air in this case having moved, in the previous 48 hours, across the English Channel and Brittany from the Bay of Biscay, the air flow being associated with a vigorous depression which, on the morning of the 12th, was centered at the mouth of the Bristol Channel.

The mean curve for this cold spell is shown in Fig. 3., and it is interesting to note that the mean minimum at 10 ft. above the ground

\* See *Meteorological Magazine*, 71, 1936, p. 286.

was  $30.2^{\circ}\text{F.}$ ,  $0.2^{\circ}\text{F.}$  below the value fixed to determine the occurrence of ground frosts.

Doubtless this has had considerable effect in retarding the growth of fruit trees, and, in tending to delay budding, will go far to save the crops from damage by frost occurring early in the month of May.

DONALD L. CHAMPION.

7, Robinson Avenue, Goff's Oak, Herts, March 20th, 1937.

### Blizzard of March 11th—13th in Ulster

Mr. J. Porter, of Moneydig, Garvagh, Co. Londonderry, writes that "the general opinion here is that the storm of March 11th and 12th is easily the greatest since April, 1917. Snow began to fall here at 3.30 p.m. on the 11th and never ceased for an hour to Saturday the 13th at 12.30 p.m. .... An hour after the snow commenced the temperature fell below  $32^{\circ}\text{F.}$  in the screen and except for about 1 hour after 2.30 p.m. on the 12th, when it rose to  $33^{\circ}\text{F.}$ , it was at or below  $32^{\circ}\text{F.}$  to 10.30 a.m. on the 13th. .... The average depth of the snow here was about 10 in. The rainwater measured 0.33 in.; this seems a small amount but the snow was very dry, also owing to the high wind the gauge probably didn't catch its proper share. Drifts on some of the roads here were 5 ft. deep and on exposed situations 10 or 12 ft. The main road from Kilrea to Belfast was completely closed for 3 days. .... This is very unusual for Ireland. Belfast was very badly affected and the milk supply had to be brought across from Scotland, the farmers being unable to get through the enormous drifts. .... The farmers in mountainous districts are very badly hit owing to the storm occurring at the beginning of the lambing season."

Mr. D. Dewar, of the Meteorological Station, R.A.F., Aldergrove, Co. Antrim, writes that "after a spell of cold weather with northerly winds and wintry showers snow began to fall about noon on March 11th and continued with short breaks until the morning of the 13th. Driven by a strong north-easterly wind the snow soon began to form drifts and by midnight on the 11th many vehicles had had to be abandoned. By the morning of the 12th practically all roads in the province were impassable for wheeled traffic and many railway services had to be cancelled. Drifts up to 10 ft. deep had accumulated near Aldergrove. Snow continued with short breaks throughout the day and night of the 12th but by the morning of the 13th the wind had decreased to moderate and the snowfall had become light. Owing to the stoppage of communications food supplies were running short in outlying districts but by the 14th most main roads were passable with care. Five persons lost their lives through the blizzard. Such severe conditions are seldom experienced in northern Ireland.

The synoptic chart for 7h. on the 11th showed a deep depression to the south-west of Ireland, moving slowly north-eastwards, with a

front running from south of Valentia to Calshot moving slowly north. By 7h. on the 12th the front had travelled to a line Holyhead to Flamborough but was only moving very slowly northwards. This retardation of the speed of the front caused the prolonged snowfall. On the morning of the 13th the depression was centred over northern England, filling up and moving slowly north-eastwards.

The effect of Lough Neagh in raising the air temperature was strikingly shown by a track of land on the west shore, about half a mile wide, remaining free from snow. At 18h. on the 11th the temperature at Aldergrove was 31° F. with an east-north-easterly force 7 wind and in view of these conditions it is rather remarkable that a track of seven miles over shallow water should have been able to raise the temperature sufficiently to turn the snow to sleet or rain."

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### Intense Thunderstorm

A very sharp—though short—thunderstorm passed over here to-day. I was, at the time, in the buildings of Orley Farm School, a few hundred yards from this house. One flash seemed to be right overhead, and almost instantly—before the thunder—I heard a sharp click answering very closely to the "vit" described by Mr. Breton and other correspondents in the *Meteorological Magazine* for June, July and August, 1928. I had just been arranging some electric lights, and my first impression was that a fuse had been blown at the other end of the room I was in; but this was not the case. It was heard by boys and masters all over the long building and gave most of them the impression that the lightning-conductor had been struck. It seems to me possible that a discharge from the conductor might have accounted for the "click." I have not yet discovered any damage.

HUGH GARDNER.

Oakhurst, Mount Park, Harrow-on-the-Hill, March 17th, 1937.

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### Lunar Rainbow

A comparatively rare phenomenon in the nature of a lunar rainbow was observed at Croydon on February 26th, 1937. Cloudless conditions with bright moonshine prevailed until 3h. 30m., when low cloud, cumulus and stratocumulus, at an estimated height of 2,500 ft., rapidly increased to 5 tenths accompanied by a slight shower at 3h. 55m. Almost immediately an arc, pure white in colour, rising to about 45°, and covering an area approximately north-north-east to east-north-east appeared.

The moon's position at that time was estimated at south-west to west-south-west, and was unobscured. A lunar halo was noted half an hour later, when high and medium cloud formed rapidly.

R. A. RASEY.

Meteorological Station, Croydon Airport, Surrey, March 4th, 1937.

## NOTES AND QUERIES

**Relative Humidity above the Desert at Ismailia, Egypt**

During 1932 two series of observations were made of relative humidity at heights of 4, 55 and 154 ft. above the desert at Ismailia. A hygrograph and dry- and wet-bulb thermometers were exposed in standard Stevenson screens at each of these heights; the proper working of the hygrograph was checked by frequent comparison with readings of the dry- and wet-bulb hygrometers. Records were obtained for the different heights as follows: March 1st to April 14th at 4 and 154 ft., April 1st to 14th at 55 ft. and June 17th to July 18th at 4 and 154 ft. The values for each hour were tabulated and mean values computed for each of the months March, April, June and July. The curves of diurnal variation of relative humidity

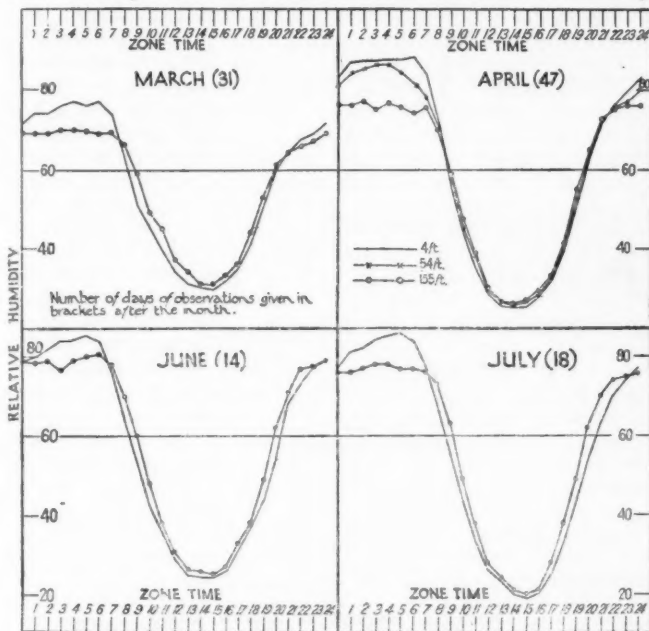


FIG. 1.

obtained from these mean values are given in Fig. 1. The decrease of relative humidity with height at night and slight increase with height during the day will be associated with the diurnal variation of the lapse rate of temperature.

Individual records shew that during the night fluctuations in relative humidity near the surface are generally small but that the

fluctuations become larger with increasing height above the surface.

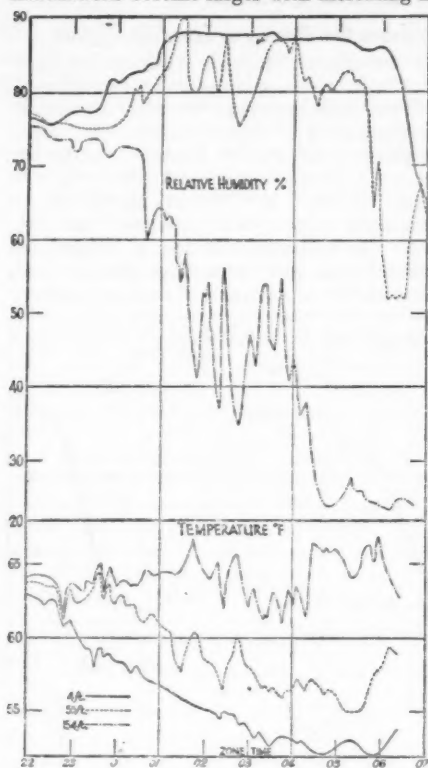


FIG. 2.

A typical case of such fluctuations was the night of April 5th-6th. The hygrograms and thermograms for 4, 55 and 154 ft. are given in Fig. 2 and it will be seen that the fluctuations increase with height. Wind at 50 ft. was northerly, 3 to 7 m.p.h. throughout the night except for two periods of calm, 23h. to 0h. 30m. and 1h. 20m. to 2h. 20m. The decrease in relative humidity at 154 ft. after 0h. 30m. was associated with an increase in wind velocity at 50 ft. from calm to 7 m.p.h. by 1h. while the minimum at 55 and 154 ft. at 2h. 35m. coincided with a wind velocity maximum of 10 m.p.h. at 50 ft. Further, the relative humidity maxima and minima at 55 and 154 ft. coincide respectively with temperature minima and maxima at these heights.

WILLIAM D. FLOWER.

### Rainfall, January to March, 1937

The persistent rains, which were a feature of the weather of January and February, 1937, continued also into March. Some details of the rainfall of January and February were given on pp. 42-3 of this magazine. Nearly all stations in the British Isles recorded a rainfall in excess of the average for both January and February, but during March the excess was continued only in the east of Great Britain and the east of Ireland. During March there was a deficiency over

the greater part of Scotland, over the north-western half of Ireland and over the north-west of England and Wales. A few stations recorded more than twice the usual amount, e.g., in parts of Kent, Cambridge, Northumberland, Co. Cork and Co. Wexford. On the other hand there was less than half the average in the north-west of Ireland and over the Western Highlands of Scotland, with only 22 per cent in parts of the latter area.

The general rainfall over the British Isles for the three months is estimated to be :—

England and Wales	...	...	...	14.8 in.
Scotland ...	...	...	...	16.7 "
Ireland ...	...	...	...	16.5 "
British Isles	...	...	...	16.3 "

The total rainfall over the British Isles was more than that recorded in any similar period back to 1870, as much as 15.5 in. being recorded in January to March, 1928. The rainfall of January to March, 1937, has, however, been exceeded in three consecutive calendar months, e.g., November, 1929 to January, 1930, with 21.6 in., or December, 1914 to February, 1915, with 19.3 in. Utilising the general values for England and Wales published in the special article in *British Rainfall*, 1931, pp. 299-306, it appears that the rainfall of January to March, 1937, over England and Wales, exceeded that of any similar period since before 1727.

At most stations in England and Wales the total rainfall January to March, 1937, exceeded the average for the first four months of the year and in the south-eastern half of England for the first five months. At Wellingborough the total reached the average up to mid-June, at Camden Square (London) up to the beginning of July and at Tenterden, in Kent, up to the last week of August.

The rainfall January to March, 1937, varied from 80 per cent of the average at Stornoway to 240 per cent at Tenterden, in Kent. In the west of Scotland and to the north of the Caledonian Canal there was less than the average, with more than 150 per cent over the Grampians. There was more than 150 per cent over the whole of England and Wales, apart from the area to the west of the Pennines and the north-western half of Wales. Falls of more than twice the average were confined to the south-east of a line drawn roughly from Dartmoor to Norfolk, with 225 per cent in the extreme south-east. In Ireland falls of more than 150 per cent were confined to the south-eastern half with 225 per cent in Co. Wexford.

The Great Ouse catchment area received about 190 per cent of the average for this period. The total rainfall from January 1st to March 21st varied over the area from 7.5 in. to 10 in. It was everywhere more than one-third of the average for the whole year and more than 40 per cent of the annual average in the south and east of the catchment area. The peak condition of flooding in this area occurred about March 17th.

J. GLASSPOOLE.

## REVIEW

*On the vertical wind distribution in anticyclones, extratropical and tropical cyclones under the influence of eddy viscosity.* By B. Haurwitz. *Beitr. Geophys. Leipzig*, Vol. 47, 1936, pp. 206-14.

This paper is essentially a sequel to a previous paper (*On the change of wind with elevation under the influence of viscosity in curved air currents. Beitr. Geophys. Leipzig*, 45, 1935, pp. 243-67) wherein the author has shewn that the gradient wind level is lower in cyclones than in anticyclones, since in the former the centrifugal force counteracts the effect of friction while it acts in the same direction in anticyclones. From this it follows that in cyclones the angle between pressure gradient and surface wind decreases with increasing distance from the centre and increases in anticyclones. In the present paper the author examines some figures due to Loomis referring to cyclones and anticyclones over the Atlantic Ocean and Europe and over the United States of America and finds reasonable qualitative confirmation of this latter deduction.

The case of the tropical cyclone is then considered and the author finds that at a distance of 20Km. from the centre and after making certain assumptions as to gradient velocity, the coefficient of eddy viscosity, etc., the wind direction becomes normal to the pressure gradient at an elevation as low as 400m. This elevation decreases nearer the centre and it is suggested that this decrease in the vertical extent of the inflow of air may partially explain the phenomenon of the "eye of the storm".

Finally, some figures due to Chambers shewing the angle between the pressure gradient and the wind in a cyclone in the Arabian Sea are examined. Here the quantitative agreement with the theory is as good as could be expected, bearing in mind the approximations employed and the unsatisfactory nature of the data.

The frequent references to the author's earlier paper make it very desirable to have a copy of that work at hand while reading this sequel.

A. C. BEST.

## BOOKS RECEIVED

*Die Münchener Registrierballonfahrten im Jahre, 1934.* By Peregrin Zistler and Hermann Zierl. Appendix to Deutsches Meteorologisches Jahrbuch für Bayern, 1934.

*Falmouth Observatory, Meteorological Notes and Tables for the years 1935 and 1936*, also additional meteorological tables for the lustrum 1931-1935 with mean values for 65 years (1871-1935). By W. T. Hooper, Falmouth, 1936 and 1937.

*Measurement of vertical currents in the atmosphere, mainly of thermal origin, with pilot balloons.* By K. R. Ramanathan and K. P. Ramakrishnan, India Meteor. Dept., Sci. Notes, Vol. VI, No. 67.

### OBITUARY

*John Hunter, O.B.E., J.P., A.M.I.C.E.*—We regret to record the death on March 12th of Mr. John Hunter of Quarry Bank, Belper, in his 84th year. Mr. Hunter established a meteorological station at Field Head House, Belper, in 1876. He transferred his station to Northfield in 1883 and to Quarry Bank in 1899. From 1880 to 1911 summaries of the observations were published in the *Meteorological Record* of the Royal Meteorological Society, and from 1912 to 1934 in the *Monthly Weather Report*. In February, 1935, on the death of his wife who had assisted him for many years in his climatological work, Mr. Hunter was obliged to discontinue the greater part of his observations. The rainfall record is, however, complete to the end of 1936, and thus covers the long period of 60 years. By the death of Mr. Hunter, the Meteorological Office has lost one of its oldest voluntary observers, and the town of Belper a greatly respected and distinguished citizen.

*Albert Richard Simpkins.*—We regret to record the death on March 13th of Mr. A. R. Simpkins in his 82nd year. He entered the Office in September, 1876, at the age of 20, being introduced by Captain Toynbee, the Marine Superintendent at that period. After serving for 37 years in the Forecast Division, he was transferred to the Statistical Division in 1913 and from that time was responsible for the compilation of the *Weekly Weather Report* and *Monthly Weather Report*. After becoming Principal Assistant he retired from the Office on December 31st, 1920. Mr. Simpkins was a man of kindly personality and a valued worker in the Baptist Church.

### NEWS IN BRIEF

Mr. J. B. Espiner of Ivy House, West Witton, Leyburn, Yorks, informs us that he has for disposal a complete series of *British Rainfall* for the years 1871 to 1935 in good condition. Anyone wishing to purchase these should communicate direct with Mr. Espiner.

The Senate of the University of London has conferred the degree of M.Sc. (Meteorology) on Mr. J. E. Belasco of the Forecast Division.

### ERRATA

FEBRUARY, 1937, p. 15, last line for "Southport" read "Manchester"  
p. 16, 7th line from bottom for "James Halliwell" read  
"Frank Lees Halliwell."

MARCH, 1937.—On p. 49 it was stated that in northern Canada the mean temperature for February was just below  $-40^{\circ}$  F. This

was incorrect; the temperatures on the north coast of Canada were between  $-20^{\circ}$  F. and  $-30^{\circ}$  F., increasing to about  $-10^{\circ}$  F. in  $60^{\circ}$  N.

MARCH, 1937, p. 29, 8th line from bottom for "July 1st, 1936" read "January 7th, 1936".

### The Weather of March, 1937

The average pressure distribution during March was rather abnormal. Pressure exceeded 1020 mb. over a large area extending from the Mississippi Valley across central Canada and the Arctic Ocean to central and southern Siberia. Pressure exceeded 1025 mb. in Saskatchewan, over almost the whole of the Arctic Ocean and in southern and central Siberia, where it reached 1030 mb. In the North Atlantic a long trough of pressure below 1005 mb. extended on both sides of the 50th parallel from Newfoundland to France and Holland. In central Canada and over Greenland, Iceland and the Arctic, pressure was more than 5 mb. above normal, the excess reaching 10 mb. between north-east Greenland and Cape Chelyuskin. By contrast, pressure was more than 10 mb. below normal over southern England.

Temperature was below  $0^{\circ}$  F. over northern Canada, the Arctic and northern Siberia, the lowest figure being  $-26^{\circ}$  F. at Cape Chelyuskin. In North America, temperature increased rapidly southward to  $17^{\circ}$  F. at Winnipeg,  $33^{\circ}$  F. at Chicago,  $59^{\circ}$  F. at New Orleans and  $73^{\circ}$  F. at Key West. In Europe temperature increased south-westwards from about  $20^{\circ}$  F. in the north of Sweden to  $30^{\circ}$  F. in southern Norway,  $40^{\circ}$  F. in the Rhine valley and  $50-55^{\circ}$  F. on the Mediterranean coast; in the British Isles the figures were  $36-37^{\circ}$  F. in Scotland,  $38-42^{\circ}$  F. in England and Ireland. Temperatures were above normal on the Pacific coast of North America, central, western and northern Canada, Spitsbergen, Finland, Russia, central Europe, Italy and the Balkans, the excess being  $10^{\circ}$  F. at Spitsbergen. Temperature was below normal over most of the United States, eastern Canada, Scandinavia, western Europe and the whole of northern and central Asia, the deficiency reaching  $11^{\circ}$  F. at Eneseisk; the British Isles were about  $4^{\circ}$  F. below normal.

Precipitation was variable but was generally above normal over England, central Europe, Russia and Finland and deficient in Scandinavia.

Cold weather prevailed generally over the British Isles during March, with much sleet and snow and sharp frosts; the number of days with sleet or snow constituted new records at Croydon, Birmingham and Eskdalemuir. Precipitation was above normal in most parts, but considerably below normal in west and south Scotland and north Wales. On the 1st moderate to strong cold northerly winds prevailed with snow generally and gales in the

west. By the 2nd the gales had abated and temperature was rising, so that on the 3rd maximum temperatures were generally above 45° F. and reached 51° F. at Ventnor. From the 4th to 9th depressions passed in an easterly direction to the south of the British Isles and cold weather prevailed generally with, until the 7th, moderate to strong easterly winds becoming light and variable on the 9th and 10th. Maximum temperatures were mostly below 40° F., and did not exceed 34° F. at Manchester and Sheffield on the 6th, while a minimum temperature of 4° F. was recorded in the screen at Dalwhinnie on the 8th. Good sunshine records were obtained in Scotland on the 7th and 8th and in Ireland on the 8th, 10·3 hrs. at Tiree on the 7th and 10·0 hrs. at Aldergrove on the 8th. Rain was general during this period and heavy locally in Ireland and south England on the 6th, 7th and 10th, 1·58 in. at Gorey, Co. Wexford on the 7th and 1·07 in. at Selbourne, Hampshire, on the 7th, while sleet or snow occurred at most places even as far south as Falmouth and Valentia. Mist or fog were reported from many parts of England on the 10th. From the 11th–13th a deep depression moved slowly north-eastwards from the mouth of the Bristol Channel to north England giving snow generally except in the south and unusually heavy snowstorms in north Ireland\* and south Scotland. Thunderstorms were reported from Birmingham and Ross-on-Wye on the 11th, while gales were experienced locally in the west, Holyhead had a gust of 77 m.p.h. on the 11th. In the south the weather was mild on the 11th, temperatures exceeding 50° F. locally. On the 14th a depression passed eastwards along the English Channel giving gales at Scilly and rain in the south. This was followed by a wedge of high pressure and the 15th was a cool sunny day over the country generally, with 10·7 hrs. bright sunshine at Armagh and 10·5 hrs. at Nairn, Malin Head and Ross-on-Wye. From the 16th to 20th pressure was low to the west and mild unsettled weather prevailed with winds between S. and E. and some rain or sleet (heavy locally on the 16th), though considerable bright periods. Owing to the continuous rains extensive flooding took place in the Fenlands and following the thawing of the snow floods occurred in the north. Thunderstorms were experienced locally in England and Ireland on the 17th, 18th and 20th, while fog occurred in parts of south Scotland and north England on the 17th–20th, and in eastern England on the 20th. On the 20th the winds backed to N. and from then to the 27th pressure was high to the west. Cold sunny anticyclonic conditions prevailed at times, but frequently the complex low-pressure area to the east brought rain, sleet and snow to all districts. 11·8 hrs. bright sunshine were experienced at Torquay on the 26th and 11·6 hrs. at Oban on the 27th. From the 28th to 30th the anticyclone to the west passed across the country and the weather was mainly sunny,

\* See p 67.

† See p. 70.

especially in the north with, however, wintry showers. On the 30th a depression was approaching Ireland and with the change to southerly winds the weather became mild in the south and west with rain in Ireland and gales in the west and north, a gust of 76 m.p.h. being recorded at Valentia on the 30th. The distribution of bright sunshine for the month was as follows:—

	Total	Diff. from normal		Total	Diff. from normal
	(hrs.)	(hrs.)		(hrs.)	(hrs.)
Stornoway ...	141	+32	Chester ...	97	-17
Aberdeen ...	99	-10	Ross-on-Wye ...	101	-15
Dublin ...	118	+3	Falmouth ...	145	+9
Birr Castle ...	110	-1	Gorleston ...	139	+11
Valentia... ..	133	+17	Kew ...	112	+4

Kew, Temperature, Mean 40·2° F., Diff. from normal - 3·7° F.

*Miscellaneous notes on weather abroad culled from various sources.*

Severe snowstorms were experienced in northern Italy on the 1st and a big avalanche fell above Blatten in the Lötschental about the 3rd completely covering an uninhabited hamlet. A gale occurred at Salonica on the 2nd. On the 14th and 15th severe gales were experienced along the western and southern coasts of France causing much damage, considerable flooding and some loss of life while floods, landslips and avalanches with some loss of life were reported from northern Italy and snow again fell on the Alps down to the 3,000 ft. level. Gales were again experienced on the French Atlantic coast on the 17th causing fresh floods, and heavy rain in Switzerland on the 21st caused many rivers to overflow while in the Engadine yellow snow was reported. Heavy rain occurred in the neighbourhood of Madrid on the 17th and snowstorms on the 23rd. Owing to an unusual ice jam 20 miles above Riga there was serious flooding in the Daugava Valley, Latvia about the 23rd. Heavy rain caused floods in the Avignon region about the 23rd and a snowstorm blocked many roads and railways in Switzerland on the 24th. A gale occurred in the western Mediterranean about the 26th. Snow fell generally in Germany over Easter and heavy snow with avalanches occurred in the higher regions and heavy rain with flooding in the lower regions in Switzerland. Serrières en Chautagne near Aix les Bains was partly destroyed by the overflowing of the river Prairie about the 27th. Easterly gales occurred in Iceland on the 30th. Ice formed no obstruction to navigation at Kalmar on the 30th. (*The Times*, March 3rd–April 1st.)

Sandstorms occurred generally in north Egypt on the 2nd. (*The Times*, March 3rd.)

An overloaded steamer capsized during a storm on the lake near Yunnanfu (China) about the 24th, all the 130 passengers except 2 being drowned. (*The Times*, March 25th.)

A hurricane struck Darwin (Northern Territory) about the 10th causing damage estimated at £95,000. The total rainfall for the month in Australia was mainly above normal in Queensland, New

South Wales, Tasmania and the southern part of Western Australia and generally below normal elsewhere. (Cable and *The Times*, March 12th-13th.)

A tornado struck Harbour Island (Bahamas) on the 30th, killing 1 woman and destroying 9 houses. In the United States temperature was generally above normal during the week ending the 9th, becoming mainly below normal later while precipitation was on the whole below normal. (*The Times*, April 1st and *Washington, D.C., U.S. Dept. Agric., Weekly Weather and Crop Bulletin.*)

### Daily Readings at Kew Observatory, March, 1937

Date	Pressure, M.S.L. 13h.	Wind, Dir., Force 13h.	Temp.		Rel. Hum. 13h.	Rain.	Sun.	REMARKS. (see vol. 69, 1934, p. 1).
			Min.	Max.				
	mb.		°F.	°F.	%	in.	hrs.	
1	998.0	NW.4	32	40	58	0.01	2.2	ps <sub>0</sub> 5h.-10h.
2	998.6	W.3	35	43	59	0.03	2.6	pr <sub>0</sub> -r <sub>0</sub> 13h.-23h.
3	1002.2	S.2	34	47	68	—	2.8	
4	996.9	ENE.5	36	45	55	—	0.7	x early f 9h.
5	1001.0	NNE.4	35	39	78	0.19	0.0	r 17h.-22h.
6	1010.2	NNE.2	33	40	73	0.06	1.0	rs 0h.-3h., 23h.-24h.
7	1003.3	NE.4	33	37	80	0.61	0.4	rs-s 0h.-11h.
8	1005.1	NE.4	34	37	70	—	0.0	s <sub>0</sub> 9h.
9	1000.6	NNE.4	32	39	57	—	3.4	
10	1001.3	SE.3	26	40	58	0.02	0.7	xf till 10h., rs 14h.
11	984.6	S.4	36	51	73	0.52	1.3	r 2h.-11h., 14h.-21h.
12	984.6	S.5	38	49	83	0.10	4.0	pr 12h.-23h.
13	986.5	WSW.3	39	46	66	0.09	5.2	rR 0h.-3h.
14	978.4	N.4	36	40	93	0.49	0.0	rs 3h.-10h.
15	1011.4	W.5	35	45	45	—	9.7	
16	1011.5	SSE.5	30	46	76	0.13	0.0	r <sub>0</sub> 12h.-21h.
17	1000.7	S.4	46	54	75	0.21	2.2	tl PRH 14h.
18	1001.2	SSW.5	45	54	67	0.02	6.0	pr 7h.-9h.
19	1002.4	S.3	42	52	78	0.03	1.9	prh 12h., pr 13h.-14h.
20	1001.7	SSE.3	36	55	61	—	7.8	F till 9h.
21	1004.3	N.3	40	46	84	0.02	0.0	r <sub>0</sub> 0h.-9h.
22	1002.7	NNE.4	36	41	56	0.01	3.5	r <sub>0</sub> s <sub>0</sub> 7h.-10h.
23	1007.4	N.4	30	42	58	trace	6.0	r <sub>0</sub> s <sub>0</sub> 19h.-20h.
24	1016.2	W.3	31	49	58	—	8.2	x early, r <sub>0</sub> 24h.
25	1013.3	W.3	38	49	53	0.17	8.1	r <sub>0</sub> 0h.-3h., 20h.-24h.
26	1009.4	WNW.4	33	45	40	0.06	9.0	r <sub>0</sub> s <sub>0</sub> 0h.-1h., s <sub>0</sub> 16h.-
27	1012.8	NNW.3	31	46	57	—	6.7	x early. [19h.
28	1019.2	NE.3	30	47	51	—	6.4	x early.
29	1025.5	ENE.3	31	45	50	—	3.1	x early.
30	1027.9	E.3	33	44	60	—	0.0	
31	1018.9	SE.3	39	53	48	—	9.4	m 21h.
*	1004.4	—	35	45	64	2.76	3.6	* Means or Totals.

### General Rainfall for February, 1937

England and Wales	...	139	} per cent of the average 1881-1915.
Scotland	...	77	
Ireland	...	109	
British Isles	...	115	

## Rainfall: March, 1937: England and Wales

Co.	STATION.	In.	Per cent of Av.	Co.	STATION.	In.	Per cent of Av.
<i>Lond.</i>	Camden Square.....	2.96	162	<i>War.</i>	Birmingham, Edgbaston	2.64	138
<i>Sur.</i>	Reigate, Wray Pk. Rd.	3.64	156	<i>Leics.</i>	Thornton Reservoir ...	2.99	163
<i>Kent.</i>	Tenterden, Ashenden...	4.70	219	"	Belvoir Castle.....	2.80	155
"	Folkestone, Boro. San.	4.92	...	<i>Rut.</i>	Ridlington .....	3.05	175
"	Margate, Cliftonville...	3.22	202	<i>Lincs.</i>	Boston, Skirbeck.....	3.03	194
"	Eden'b'dg., Falconhurst	3.67	148	"	Cranwell Aerodrome...	2.14	153
<i>Sus.</i>	Compton, Compton Ho.	4.04	146	"	Skegness, Marine Gdns.	2.53	153
"	Patching Farm.....	3.88	180	"	Louth, Westgate.....	2.52	119
"	Eastbourne, Wil. Sq....	4.36	193	"	Brigg, Wrawby St.....	1.90	...
<i>Hants.</i>	Ventnor, Roy.Nat.Hos.	4.34	212	<i>Notts.</i>	Worksop, Hodgecock....	1.78	105
"	Fordingbridge, Oaklands	3.36	144	<i>Derby.</i>	Derby, L. M. & S. Rly.	2.12	123
"	Ovington Rectory.....	...	...	"	Buxton, Terr. Slopes...	4.36	106
"	Sherborne St. John.....	4.10	183	<i>Ches.</i>	Bidston Obay.....	1.31	69
<i>Herts.</i>	Royston, Therfield Rec.	3.61	197	<i>Lancs.</i>	Manchester, Whit. Pk.	1.35	60
<i>Bucks.</i>	Slough, Upton.....	2.93	166	"	Stonyhurst College.....	1.79	49
"	H. Wycombe, Flackwell	3.31	165	"	Southport, Bedford Pk.	1.24	56
<i>Oxf.</i>	Oxford, Radcliffe.....	3.05	185	"	Ulverston, Poaka Beck	2.53	65
<i>N'hant.</i>	Wellingboro, Swanspool	3.30	185	"	Lancaster, Greg Obay.	1.56	49
"	Oundle .....	3.36	...	"	Blackpool .....	1.36	57
<i>Bed.</i>	Woburn, Exptl. Farm...	3.27	191	<i>Yorks.</i>	Wath-upon-Deane.....	2.52	145
<i>Cam.</i>	Cambridge, Bot. Gdns.	3.52	240	"	Wakefield, Clarence Pk.	2.41	134
"	March .....	3.10	196	"	Oughtershaw Hall.....	3.69	...
<i>Essex.</i>	Chelmsford, County Gdns	2.48	143	"	Wetherby, Ribston H.	2.19	112
"	Lexden Hill House.....	2.81	...	"	Hull, Pearson Park.....	2.08	114
<i>Suff.</i>	Haughley House.....	2.72	...	"	Holme-on-Spalding.....	2.79	154
"	Rendlesham Hall.....	2.50	149	"	West Witton, Ivy Ho.	3.20	103
"	Lowestoft Sec. School...	2.01	125	"	Felixkirk, Mt. St. John.	2.62	133
"	Bury St. Ed., Westley H.	3.66	194	"	York, Museum Gdns....	2.26	134
<i>Norf.</i>	Wells, Holkham Hall...	3.22	198	"	Pickering, Hungate.....	3.08	155
<i>Wilts.</i>	Porton, W.D. Exptl. Stn	4.17	211	"	Scarborough.....	3.63	202
"	Bishops Cannings.....	3.03	161	"	Middlebrough.....	2.93	187
<i>Dor.</i>	Weymouth, Westham...	4.21	204	"	Baldersdale, Hury Res.	2.55	82
"	Beaminster, East St....	4.08	160	<i>Durh.</i>	Ushaw College.....	3.93	178
"	Shaftesbury, Abbey Ho.	4.14	176	<i>Nor.</i>	Newcastle, Leazes Pk...	2.57	125
<i>Devon.</i>	Plymouth, The Hoe....	4.84	166	"	Bellingham, Highgreen	2.78	95
"	Holne, Church Pk. Cott.	7.81	145	"	Lilburn Tower Gdns...	5.39	203
"	Teignmouth, Den Gdns.	5.70	219	<i>Cumb.</i>	Carlisle, Scaleby Hall...	...	...
"	Cullompton .....	4.96	108	"	Borrowdale, Seathwaite	...	...
"	Sidmouth, U.D.C.....	4.62	...	"	Thirlmere, Dale Head H.	5.40	83
"	Barnstaple, N. Dev. Ath	3.31	126	"	Keswick, High Hill.....	3.05	68
"	Dartn'r, Cranmere Pool	9.30	...	<i>West.</i>	Appleby, Castle Bank...	1.85	69
"	Okehampton, Uplands...	7.71	186	<i>Mon.</i>	Abergavenny, Larchfd	4.96	163
"	Redruth, Trewirgie.....	6.17	171	<i>Glam.</i>	Ystalyfera, Wern Ho...	3.77	70
<i>Corn.</i>	Penzance, Morrab Gdns.	6.06	189	"	Treherbert, Tynywaun.	5.35	...
"	St. Austell, Trevarna...	6.43	187	"	Cardiff, Penylan.....	3.72	118
<i>Soms.</i>	Chewton Mendip.....	4.85	136	<i>Carm.</i>	Carmarthen, Model & P.S.	3.22	81
"	Long Ashton.....	3.48	137	<i>Pemb.</i>	St. Ann's Hd, C. Gd. Stn.	2.74	106
"	Street, Millfield.....	3.76	...	<i>Card.</i>	Aberystwyth .....	1.76	...
<i>Glos.</i>	Blockley .....	3.71	...	<i>Rad.</i>	Birm W.W. Tyrmynydd	4.72	88
"	Cirencester, Gwynfa...	3.70	160	<i>Mont.</i>	Lake Vyrnwy .....	3.80	89
<i>Here.</i>	Ross-on-Wye.....	4.11	202	<i>Flint.</i>	Sealand Aerodrome.....	1.95	...
<i>Salop.</i>	Church Stretton.....	3.28	139	<i>Mer.</i>	Blaenau Festiniog.....	...	...
"	Shifnal, Hatton Grange	2.43	132	"	Dolgelley, Bontddu.....	3.08	62
"	Cheswardine Hall.....	2.21	...	<i>Carn.</i>	Llandudno .....	1.61	79
<i>Worc.</i>	Malvern, Free Library...	2.94	152	"	Snowdon, L. Llydaw 9.	5.85	...
"	Ombersley, Holt Lock.	2.66	157	<i>Ang.</i>	Holyhead, Salt Island...	1.54	59
<i>War.</i>	Alcester, Ragley Hall...	3.16	184	"	Lligwy .....	1.45	...

## Rainfall: March, 1937: Scotland and Ireland

Co.	STATION.	In.	Per cent of Av.	Co.	STATION.	In.	Per cent of Av.
<i>I. Man</i>	Douglas, Boro' Cem...	3.59	121	<i>RdC</i>	Achnashellach .....	2.01	28
<i>Guern.</i>	St. Peter P't. Grange Rd.	5.10	207	"	Stornoway, C. Guard Stn.	1.96	...
<i>Wig</i>	Pt. William, Monreith.	1.43	50	<i>Suth</i>	Lairg .....	2.82	91
"	New Luce School .....	1.96	55	"	Tongue .....	...	...
<i>Kirk</i>	Dalry, Glendarroch .....	3.07	68	"	Melvich .....	2.31	81
<i>Dumf.</i>	Dumfries, Crichton R.I.	1.68	60	"	Loch More, Achfary...	4.37	68
"	Eskdalemuir Obs .....	3.21	66	<i>Caith</i>	Wick .....	1.96	86
<i>Roxb</i>	Hawick, Wolfelce .....	2.72	81	<i>Ork</i>	Deerness .....	2.55	91
<i>Peeb</i>	Stobo Castle .....	2.02	70	<i>Shet</i>	Lerwick .....	2.15	68
<i>Berw</i>	Marchmont House .....	3.76	142	<i>Cork</i>	Dunmanway Rectory...	5.50	112
<i>E. Lot</i>	North Berwick Res .....	2.17	115	"	Cork, University Coll.	...	...
<i>Midl</i>	Edinburgh, Blackfd. H.	1.70	86	"	Mallow, Longueville...	6.24	215
<i>Lan</i>	Auchtyfardle .....	1.43	...	<i>Kerry</i>	Valentia Obsy .....	4.94	109
<i>Ayr</i>	Kilmarnock, Kay Pk .....	.86	...	"	Gearhameen .....	6.80	84
"	Girvan, Pimmore .....	2.27	60	"	Bally McElligott Rec.	2.79	...
"	Glen Afton, Ayr San .....	2.09	50	"	Darrynane Abbey .....	4.34	106
<i>Benf</i>	Glasgow, Queen's Pk .....	1.33	51	<i>Wat</i>	Waterford, Gortmore...	5.04	185
"	Greenock, Prospect H.	1.65	34	<i>Tip</i>	Nenagh, Cas. Lough...	2.36	76
<i>Bute</i>	Rothesay, Ardenraig .....	2.16	60	"	Roscrea, Timoney Park	2.72	...
"	Dougarie Lodge .....	2.82	81	"	Cashel, Ballinamona...	2.72	100
<i>Arg</i>	Lock Sunart, G'dale .....	1.19	21	<i>Lim</i>	Foynes, Coolnanes .....	1.99	68
"	Ardgour House .....	1.08	...	<i>Clare</i>	Inagh, Mount Callan...	3.16	...
"	Glen Etive .....	...	...	<i>Wexf</i>	Gorey, Courtown Ho...	6.12	265
"	Oban .....	.38	...	<i>Wick</i>	Rathnew, Clonmannon	5.26	...
"	Poltalloch .....	1.58	41	<i>Carl</i>	Bagnalstown, Fanagh H.	4.62	191
"	Inveraray Castle .....	1.40	22	"	Hacketstown Rectory...	4.61	165
"	Islay, Eallabus .....	2.13	56	<i>Leiz</i>	Blandsfort House .....	4.45	170
"	Mull, Benmore .....	2.50	24	<i>Offaly</i>	Birr Castle .....	2.06	86
"	Tiree .....	...	...	<i>Kild</i>	Straffan House .....	3.74	161
<i>Kinr</i>	Loch Leven Sluice .....	2.66	89	<i>Dublin</i>	Dublin, Phoenix Park...	4.72	242
<i>Fife</i>	Leuchars Aerodrome...	2.61	134	<i>Meath</i>	Kells, Headfort .....	3.12	113
<i>Perth</i>	Loch Dhu .....	2.70	41	<i>W.M</i>	Moate, Coolatore .....	2.66	...
"	Crieff, Strathearn Hyd.	2.68	84	"	Mullingar, Belvedere...	2.66	99
"	Blair Castle Gardens...	1.72	66	<i>Long</i>	Castle Forbes Gdns...	2.12	72
<i>Angus</i>	Kettins School .....	2.92	120	<i>Gal</i>	Galway, Grammar Sch.	1.45	48
"	Pearsie House .....	3.50	...	"	Ballynahinch Castle...	2.62	51
"	Montrose, Sunnyside...	2.58	124	"	Ahascragh, Clonbrock.	1.80	54
<i>Aber</i>	Balmoral Castle Gdns...	5.31	186	<i>Rosc</i>	Strokestown, C'node...	1.93	70
"	Logie Coldstone Sch...	4.49	173	<i>Mayo</i>	Blacksod Point .....	...	...
"	Aberdeen, Observatory.	2.70	112	"	Mallaranny .....	2.05	...
"	New Deer School House	3.34	125	"	Westport House .....	2.52	65
<i>Moray</i>	Gordon Castle .....	2.72	117	"	Delphi Lodge .....	4.59	55
"	Grantown-on-Spey .....	...	...	<i>Sligo</i>	Markree Castle .....	1.60	47
<i>Nairn</i>	Nairn .....	1.39	74	<i>Cavan</i>	Crossdoney, Kevit Cas.	1.63	...
<i>Ino's</i>	Ben Alder Lodge .....	2.26	...	<i>Fern</i>	Newtownbltr, Crom Cas.	1.44	47
"	Kingussie, The Birches.	2.39	...	<i>Arm</i>	Armagh Obsy .....	2.29	97
"	Loch Ness, Foyers .....	1.97	61	<i>Down</i>	Fofanny Reservoir .....	9.17	...
"	Inverness, Culduthel R.	1.61	73	"	Seaford .....	4.38	150
"	Loch Quoich, Loan .....	1.35	...	"	Donaghadee, C. G. Stn.	2.92	133
"	Glenquoich .....	2.80	29	<i>Antr</i>	Belfast, Queen's Univrsty	3.43	...
"	Arisaig House .....	1.05	22	"	Aldergrove Aerodrome.	2.71	108
"	Glenleven, Corroul .....	...	...	"	Ballymena, Harryville.	3.65	116
"	Fort William, Glasdrum	1.20	...	<i>Lon</i>	Garvagh, Moneydig .....	2.37	...
"	Skye, Dunvegan .....	1.81	...	"	Londonderry, Creggan.	1.54	48
"	Barra, Skallary .....	1.28	...	<i>Tyr</i>	Omagh, Edenfel .....	1.98	63
<i>RdO</i>	Alness, Ardross Castle.	3.49	107	<i>Don</i>	Malin Head .....	.96	...
"	Ullapool .....	1.89	45	"	Killybegs, Rockmount.	...	...

## Climatological Table for the British Empire, October, 1936

STATIONS.	PRESSURE.		TEMPERATURE.						Relative Humidity.	Mean Cloud Am't	PRECIPITATION.		BRIGHT SUNSHINE.		
	Mean of Day M.S.J.	Diff. from Normal.	Absolute.			Mean Values					Diff. from Normal	Wet Bulb.		Am't.	Days.
			Max.	Min.	°F.	Max.	1 and 2 Min.	°F.							
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	%	0-10	In.	In.	Hours per day.	Percentage of possible.	
London, Kew Obsv...	1019.5	+ 5.5	65	33	56.1	42.8	49.5	- 1.4	44.5	89	6.9	1.79	11	2.9	27
Gibraltar	1018.9	+ 1.7	74	53	67.9	59.5	63.7	...	58.2	83	5.1	1.90	10	...	...
Malta	1015.2	- 0.8	80	52	71.8	63.7	67.7	- 3.2	62.2	77	6.7	1.52	13	5.5	49
St. Helena	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Freetown, Sierra Leone	1012.4	+ 2.5	89	69	85.6	73.2	79.4	...	75.2	83	4.6	10.09	27	...	...
Lagos, Nigeria	1012.1	+ 1.1	87	71	84.1	74.1	79.1	- 0.6	75.4	87	8.0	13.88	18	5.3	44
Kaduna, Nigeria	1011.7	- 0.1	100	61	89.4	66.5	77.9	+ 1.6	71.0	87	5.3	4.82	9	8.1	68
Zomba, Nyasaland	1011.7	- 0.1	92	57	85.7	64.4	75.1	+ 1.0	66.8	61	4.3	0.89	6	...	...
Salisbury, Rhodesia	1011.6	+ 0.8	89	51	82.1	58.0	70.1	- 0.6	59.1	49	3.3	3.43	9	8.4	67
Cape Town	1018.9	+ 1.5	89	41	70.5	53.0	61.7	+ 0.5	55.3	76	5.2	0.95	11	...	...
Johannesburg	1012.9	- 0.6	80	43	72.8	50.6	61.7	+ 1.1	51.6	84	4.4	1.47	11	8.9	70
Mauritius	1017.6	- 0.6	84	62	80.8	66.4	73.6	+ 0.9	68.5	66	5.3	3.37	18	8.4	67
Calcutta, Alipore Obsv.	1010.4	+ 1.0	93	70	87.7	75.0	81.3	+ 2.0	75.7	88	3.9	4.75	...	...	...
Bombay	1010.7	+ 0.9	97	73	90.1	76.2	83.1	+ 0.7	75.5	78	2.3	0.01	1.66	0*	...
Madras	1009.2	+ 0.3	97	72	89.7	76.2	82.9	+ 0.6	77.3	80	6.0	8.16	2.99	9*	...
Columbo, Ceylon	1010.8	+ 0.8	86	72	85.2	75.1	80.1	- 0.4	77.1	79	6.6	10.69	19	7.9	66
Singapore	1010.0	+ 0.3	89	71	84.6	74.7	79.7	- 1.4	76.9	83	8.0	11.57	23	4.5	37
Hongkong	1014.1	+ 0.4	88	65	82.6	71.0	76.8	- 0.1	66.5	55	3.3	1.89	3	8.2	71
Sandakan	1009.2	- 2.1	90	73	87.4	74.8	81.1	- 0.3	76.9	83	8.5	9.29	1.04	...	...
Sydney, N.S.W.	1012.7	- 2.1	97	51	74.1	57.2	65.7	+ 2.1	58.6	52	5.3	1.15	1.70	6	64
Melbourne	1012.7	- 2.1	81	39	67.4	47.9	57.7	+ 0.0	51.8	58	7.7	2.40	17	5.2	40
Adelaide	1015.9	- 0.1	91	44	70.6	52.3	61.5	+ 0.5	54.2	52	7.3	2.43	10	6.0	47
Perth, W. Australia	1017.8	+ 1.0	95	47	70.6	53.4	62.0	+ 1.2	54.9	57	5.2	1.00	1.22	10	72
Coolgardie	1015.3	+ 0.4	97	45	77.4	50.8	64.1	+ 0.4	52.5	41	2.5	0.09	1	...	...
Brisbane	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hobart, Tasmania	1005.6	- 4.7	69	38	61.7	45.9	53.8	- 0.3	47.4	56	6.5	1.65	0.61	7.0	53
Wellington, N.Z.	1013.2	+ 0.1	70	38	60.3	48.8	54.5	- 0.1	52.0	79	7.7	3.33	0.75	14	42
Suva, Fiji	1013.2	- 0.4	89	65	81.4	70.6	76.0	+ 0.2	72.8	83	6.6	27.31	19.02	22	5.7
Apia, Samoa	1011.1	- 0.0	87	71	85.1	74.6	79.9	+ 1.5	76.7	79	6.0	12.97	6.59	17	46
Kingston, Jamaica	1011.7	+ 0.2	91	68	87.9	72.4	80.1	- 0.4	72.0	90	3.8	3.79	8	3.6	31
Grenada, W.I.	1011.1	+ 0.3	90	71	87	73	80	- 0.1	74	74	4	1.62	6.14	11	...
Toronto	1017.3	- 0.2	73	21	56.8	41.2	49.0	+ 0.4	42.9	87	6.1	2.44	0.13	14	4.7
Winnipeg	1016.6	+ 1.7	80	-5	45.7	25.1	35.4	- 5.3	27.8	78	6.4	1.00	0.37	8	39
St. John, N.B.	1016.6	- 0.8	68	-22	53.7	39.5	46.6	+ 1.3	43.9	83	6.9	4.88	0.34	12	4.5
Victoria, B.C.	1020.5	+ 3.4	76	41	59.2	47.5	53.3	+ 3.0	50.9	85	6.4	0.96	8	4.6	42

Winnipeg, ..... 1016.6	+	1.7	80	-5	46.7	26.1	35.4	-	5.3	27.8	78	6.4	1.00	-	0.37	8	4.2	39
St. John, N.B., ..... 1016.6	+	0.8	68	22	53.7	39.5	46.6	+	1.3	43.9	83	6.9	4.88	+	0.34	12	4.5	41
Victoria, B.C., ..... 1020.5	+	3.4	76	41	59.2	47.5	53.3	+	3.0	50.9	85	6.4	0.96	-	1.61	8	4.6	42